



GL10-RTU-ECTA

EtherCAT Communication Module User Guide



19011107A04

Overview

Thank you for purchasing the GL10-RTU-ECTA EtherCAT communication module developed and manufactured independently by Inovance. It is an EtherCAT bus slave expansion module. It provides the automatic scanning function. Each GL10-RTU-ECTA module can connect up to 16 modules (DI/DO/AI/AO).

This guide describes the specifications, characteristics and using methods of this module. Read this guide carefully before using to ensure more safe usage. You can download the latest materials from [www.inovance.com](http://www.inovance.com).

Safety Precautions

Safety Disclaimer

1. Read the safety precautions before installing, operating, and maintaining this product.
2. To ensure personal and equipment safety, follow all safety precautions marked on the product and described in the user guide when installing, operating, and maintaining this product.
3. Note that "CAUTION", "WARNING", and "DANGER" only serve as supplements to the safety precautions.
4. Use this product in an environment that complies with the design specifications. Malfunctions or component damage caused by improper use is not covered by warranty.
5. Inovance shall not be liable for any physical injuries or property loss caused by improper use.

Safety Categories and Definitions

**WARNING** : Indicates that failure to comply with the notice may result in severe physical injuries or even death.

**CAUTION** : Indicates the improper operation which, if not avoided, may cause moderate or minor injury, as well as equipment damage.

Keep this guide properly for future reference and forward it to the end user.

Control System Design

WARNING

- ◆ Design a safety circuit to ensure that the control system can still work safely upon an external power outage or programmable controller failure.
- ◆ The product may catch fire or emit smoke in case of prolonged overcurrent due to overload or short circuit of load. Therefore, configure an external safety device such as a fuse or circuit breaker.

CAUTION

- ◆ Design an external emergency stop circuit, protective circuit, forward and reverse rotation interlock circuit, as well as up and down limit interlock circuit to be connected to the programmable controller.
- ◆ Design an external protective circuit and a safety mechanism for output signals that may cause major incidents.
- ◆ When the programmable controller CPU detects a system exception, it may turn off all outputs. When partial circuit of the controller malfunctions, the controller outputs may become uncontrollable. To ensure proper operation, it is necessary to design an appropriate external control circuit.
- ◆ If the PLC's output units such as relays or transistors are damaged, the output may fail to switch between ON and OFF states according to the commands.
- ◆ The programmable controller is intended for use in an indoor electrical environment with an overvoltage class of II. The power system must contain a lightning arrester to prevent lightening from causing overvoltage on the power supply input, signal input, and control output terminals of the programmable controller and damaging the equipment.

Installation

WARNING

- ◆ Only allow trained professionals with electrical expertise to install this product.
- ◆ Cut off all external power sources before you install or remove this product. Failure to comply may result in electric shock or faults or malfunctions of this product.
- ◆ Do not use the programmable controller in places with dirt, oily fume, conductive dust, corrosive gas, flammable gas, high temperature, condensation, wind and rain, vibration, or shock. Electric shock, fire, and improper operation will lead to damage and deterioration of the product.
- ◆ The programmable controller is an open-type device to be installed in a control cabinet with a door lock (housing IP rating higher than IP20). Only allow trained operators with electrical expertise to open the cabinet.

CAUTION

- ◆ Prevent metal filings and wire ends from dropping into ventilation holes of the PLC during installation. Failure to comply may result in fire, fault and malfunction.
- ◆ After installation, ensure that no unwanted objects exist on the ventilation surface. Failure to comply may result in poor heat dissipation, fire, faults, or malfunctions.
- ◆ During installation, tightly connect the product and its connectors and firmly lock its hooks. Improper module installation may lead to malfunctions, faults, and detachment.

Wiring

WARNING

- ◆ Only allow trained professionals with electrical expertise to conduct wiring for this product.
- ◆ Cut off all external power sources before wiring. Failure to comply may result in electric shock or equipment faults or malfunctions.
- ◆ Install the terminal cover delivered with the equipment when you energize and operate the equipment after wiring. Failure to comply may result in electric shock.
- ◆ Properly insulate the cable terminals and ensure a proper insulation distance between the cables connected to the terminal block. Failure to comply will result in electric shock or equipment damage.

CAUTION

- ◆ Prevent metal filings and wire ends from dropping into ventilation holes of the PLC during wiring. Failure to comply may result in fire, fault and malfunction.
- ◆ The external wiring specification and installation method must comply with local regulations. For details, see the wiring section in this guide.
- ◆ To ensure safety of equipment and operator, use cables with sufficient diameter and connect the cables to ground reliably.
- ◆ Wire the module correctly after making clear of the connector type. Failure to comply may result in module and external equipment fault.
- ◆ Tighten bolts on the terminal block in the specified torque range. If the terminal is not tight, short-circuit, fire or malfunction may be caused. If the terminal is too tight, fall-off, short-circuit, fire or malfunction may be caused.
- ◆ If the connector is used to connect with external equipment, perform correct crimping or welding with the tool specified by manufacturer. If connection is in poor contact, short-circuit, fire or malfunction may be caused.
- ◆ A label on the top of the module is to prevent foreign matters entering the module. Do not remove the label during wiring. Remember to remove it before system operation, facilitating ventilation.
- ◆ Do not bundle control wires, communication wires and power cables together. They must be run with distance of more than 100 mm. Otherwise, noise may result in malfunction.
- ◆ Select shielded cable for high-frequency signal input/output in applications with serious interference so as to enhance system anti-interference ability.

Operation and Maintenance

WARNING

- ◆ Only allow trained professionals with electrical expertise to operate and maintain this product.
- ◆ Do not touch terminals when the power is on. Failure to comply may result in electric shock or malfunctions.
- ◆ Cut off all external power sources before you clean the module or re-tighten bolts and connectors to the terminal block. Failure to comply may result in electric shock.
- ◆ Disconnect all external power supplies of the system before removing the module or connecting/removing the communication wirings. Failure to comply may result in electric shock or malfunctions.

CAUTION

- ◆ Get acquainted with the guide and ensure safety before online modification, forcible output, and RUN/STOP operation.
- ◆ Disconnect the power supply before installing/removing the expansion card.

Disposal

CAUTION

- ◆ Dispose of this product as industrial wastes. Dispose of the battery separately in accordance with local laws and regulations.

Product Information

Model and Nameplate

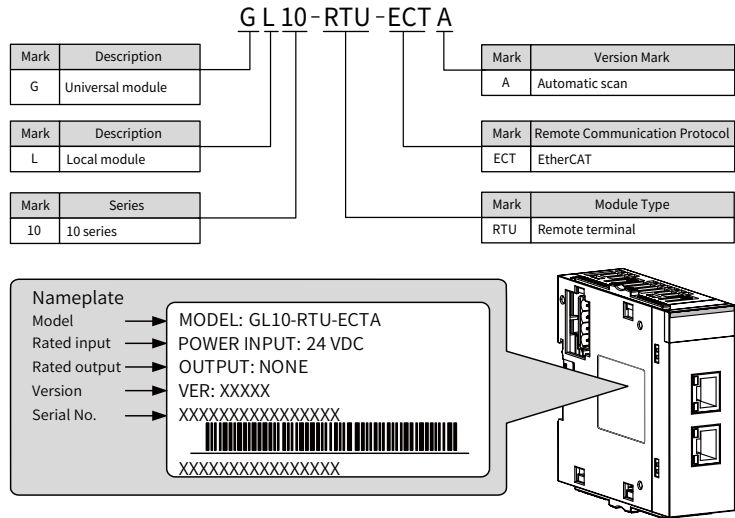


Figure 1 Description of model and nameplate

| Model         | Category                      | Description                                      |
|---------------|-------------------------------|--------------------------------------------------|
| GL10-RTU-ECTA | EtherCAT communication module | EtherCAT protocol communication interface module |

External Interface

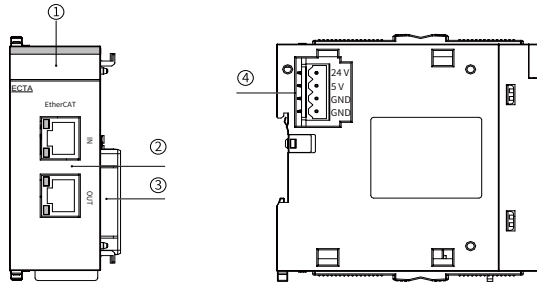


Figure 2 Diagram of EtherCAT communication module interface

| No. | Interface                                    | Function                                                           |                                    |       |                                                                                                                                                                                                   |
|-----|----------------------------------------------|--------------------------------------------------------------------|------------------------------------|-------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| ①   | Signal indicator                             | POWER                                                              | Power indicator                    | Green | ON upon power-on                                                                                                                                                                                  |
|     |                                              | RUN                                                                | Running status indicator           | Green | ON when the module is running properly.<br>Off when the module is in state INIT. Blinking when the module is in state PRE-OPERATIONAL. Single flash when the module is in state SAFE OPERATIONAL. |
|     |                                              | SF                                                                 | Expansion module and network error | Red   | Single flash when an error occurs in the expansion module.<br>Blinking when the module is disconnected from the network.                                                                          |
|     |                                              | BF                                                                 | Communication error indicator      | Red   | Blinking when a communication error occurs.                                                                                                                                                       |
| ②   | IN                                           | EtherCAT input port                                                |                                    |       |                                                                                                                                                                                                   |
|     | OUT                                          | EtherCAT output port, used to connect to a back-end EtherCAT slave |                                    |       |                                                                                                                                                                                                   |
| ③   | Local expansion module back-end interface    | Connected to a back-end module                                     |                                    |       |                                                                                                                                                                                                   |
| ④   | Input terminal of 24 V internal power supply | Connected to a power module                                        |                                    |       |                                                                                                                                                                                                   |

General Specifications

| Item                                    | Specifications                                                                                                       |
|-----------------------------------------|----------------------------------------------------------------------------------------------------------------------|
| Power supply specifications             | 24 VDC (20.4 VDC to 28.8 VDC) (–15% to +20%)                                                                         |
| Communication protocol                  | EtherCAT industrial real-time bus protocol                                                                           |
| Maximum communication rate              | Ethernet 100 Mbps                                                                                                    |
| Network port/Network cable              | Standard Ethernet port and standard Ethernet cable (Cat 5e network cable) with a cable length of not more than 100 m |
| Station ID range                        | 1 to 125. The internal address is automatically arranged in the network bus connection sequence.                     |
| Expandability of subsequent I/O modules | Up to 16 I/O modules can be added. The actual number and configuration depend on each module's power consumption.    |

Environmental Parameters

| Type              |                   | Operating Environment                 | Transportation Environment | Storage Environment |
|-------------------|-------------------|---------------------------------------|----------------------------|---------------------|
| Environment class |                   | IE33                                  | IE22                       | IE12                |
| Temperature       |                   | –5° C to +55° C                       | –40° C to +70° C           | –25° C to +70° C    |
| Humidity          |                   | 10% to 95%, non-condensing            |                            |                     |
| Vibration         | Frequency         | 5 Hz to 150 Hz                        | 2M2                        | 1M2                 |
|                   | Displacement      | 3.5 mm (direct installation) (< 9 Hz) |                            |                     |
|                   | Acceleration rate | 1 g (direct installation) (> 9 Hz)    |                            |                     |
|                   | Orientation       | 3 axial directions                    |                            |                     |

Specific Performance Indexes Reached Are Shown in the Following Table:

| Item                       | Specifications                            |
|----------------------------|-------------------------------------------|
| Communication protocol     | EtherCAT protocol                         |
| Application layer protocol | ETG.5001.1 S(D) V0.1.1                    |
| Service supported          | CoE (PDO and SDO)                         |
| Physical layer             | 100BASE-TX                                |
| Baud rate                  | 100 Mbps (100Base-TX)                     |
| Duplex mode                | Full duplex                               |
| Topology structure         | Linear topology                           |
| Transmission media         | Network cable (For details, see "Wiring") |
| Transmission distance      | Less than 100 m between two nodes         |
| Number of slaves           | Up to 125 slaves                          |
| EtherCAT frame length      | 44 bytes to 1,498 bytes                   |

| Item                                 | Specifications                                                                       |
|--------------------------------------|--------------------------------------------------------------------------------------|
| Process data                         | Maximum 1,486 bytes per Ethernet frame                                               |
| Synchronization jitter of two slaves | < 1 μs                                                                               |
| Refresh time                         | About 30 μs for 1,000 digital inputs and outputs, and about 100 μs for 32 servo axes |

### Module Power Consumption:

GL10-RTU-ECTA is an EtherCAT communication module with a rated power consumption of 1,500 mA, and up to 16 expansion modules can be connected.

| Module       | Rated Power Consumption (mA) | Specifications                                   |
|--------------|------------------------------|--------------------------------------------------|
| GL10-0016ETN | 85                           | 16-channel digital output module (NPN)           |
| GL10-0016ETP | 65                           | 16-channel digital output module (PNP)           |
| GL10-0016ER  | 65                           | 16-channel digital output module (relay)         |
| GL10-0032ETN | 115                          | 32-channel digital output module (NPN)           |
| GL10-1600END | 55                           | 16-channel digital input module (source/sink)    |
| GL10-3200END | 65                           | 32-channel digital input module (source/sink)    |
| GL10-4AD     | 85                           | 4-channel analog input module (voltage/current)  |
| GL10-4DA     | 85                           | 4-channel analog output module (voltage/current) |
| GL10-4PT     | 85                           | 4-channel temperature module                     |



NOTE

The specific number of modules that can be connected depends on the total rated current.

## Mechanical Design Reference

### Mounting Dimensions

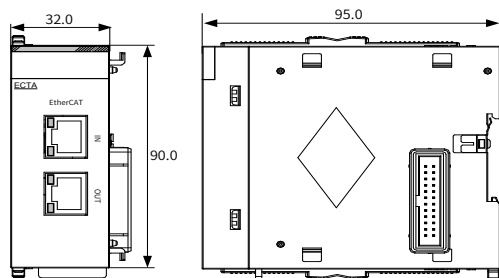


Figure 3 Mounting dimensions (in mm)

## Electrical Design Reference

### EtherCAT Communication Interface Description

The EtherCAT bus uses a standard RJ45 network port and a standard connector.

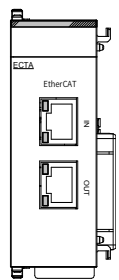


Figure 4 Terminal arrangement

### Wiring

#### Network cable preparation

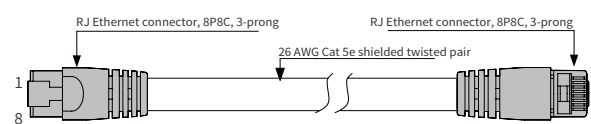


Figure 5 EtherCAT cable preparation requirements

#### Signal pin assignment

| Pin | Signal | Direction | Description        |
|-----|--------|-----------|--------------------|
| 1   | TD+    | Output    | Data transmission+ |
| 2   | TD-    | Output    | Data transmission- |
| 3   | RD+    | Input     | Data receive+      |

| Pin | Signal | Direction | Description   |
|-----|--------|-----------|---------------|
| 4   | -      | -         | Reserved      |
| 5   | -      | -         | Reserved      |
| 6   | RD-    | Input     | Data receive- |
| 7   | -      | -         | Reserved      |
| 8   | -      | -         | Reserved      |

#### Length requirements:

FastEthernet technology demonstrates that the cable length between devices shall not exceed 100 m when the EtherCAT bus is used. Otherwise, it will cause signal attenuation, affecting normal communication.

#### Technical requirements:

There is no evidence of short circuit, open circuit, displacement, or poor contact during the 100% continuity test.

Use a shielded cable as the EtherCAT bus for network data transmission, with the following recommended specifications:

| Item            | Specifications                                                                   |
|-----------------|----------------------------------------------------------------------------------|
| Cable type      | Flexible crossover cable, S-FTP, Cat 5e                                          |
| Compliance      | EIA/TIA568A, EN50173, ISO/IEC11801<br>EIA/TI Abulletin TSB, EIA/TIA SB40-A&TSB36 |
| Conductor size  | AWG26                                                                            |
| Conductor type  | Twisted pair                                                                     |
| Number of pairs | 4                                                                                |

### Communication Connection

#### 1) Connection of RJ45 network cable

- ◆ Insert the cable connector into the RJ45 port of the communication module until you hear a click sound.

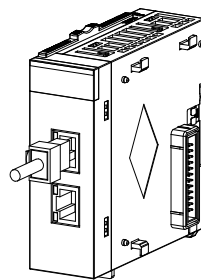


Figure 6 Diagram of network cable connection

- ◆ Removal: Press the retaining latch of the cable connector while pulling out the connector in the direction parallel to the port.

#### 2) Ethernet cable requirements:



Figure 7 Ethernet cable requirements

Use Cat 5e shielded twisted pair (STP) cables, with injection molded and iron shelled connector.

#### 3) Communication cable fixing requirements:

To protect the communication cable from tension and to ensure communication stability, fix the cable near the equipment before EtherCAT communication, as shown in the following figure.

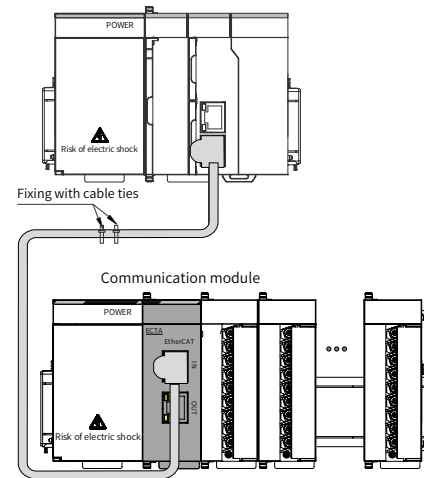


Figure 8 Fixing of the communication cable near the equipment

| LED Indicator | Meaning  |                                                                                                                                                                                                                                                                                     | Solution                                                                                                                                                                               |
|---------------|----------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| RUN           | OFF      | The EtherCAT master is not connected to the EtherCAT slave.                                                                                                                                                                                                                         | Check the configuration and parameter settings.<br>Check the communication address.<br>Check whether the specifications and length of the network cable meet the requirements.         |
|               | Blinking | The EtherCAT slave is in a non-OP state.                                                                                                                                                                                                                                            | Check the slave configuration.<br>Check whether any required module is missing or faulty.<br>Check whether any module is not configured.                                               |
| BF            | Blinking | The EtherCAT master does not exchange data with the EtherCAT slave.<br>A status conversion instruction that cannot be executed is received during EtherCAT communication.<br>The ECTA module has a synchronization error.<br>A watchdog error occurs during EtherCAT communication. | Check whether the RJ45 connector is correctly inserted.<br>Check whether the network cable is damaged.<br>Restart the power supply.<br>Check whether the PDO configuration is correct. |
| SF            | Blinking | A configuration error occurs.<br>Indicates the module error.                                                                                                                                                                                                                        | Check whether the host controller configuration is consistent with the module configuration.<br>Check whether the module suffers from interference.                                    |

## Software Diagnosis

### Fault Type

All faults of the GL10-RTU-ECTA EtherCAT communication module support object dictionary access, and fault information can be further confirmed through object dictionary.

When a fault occurs, the fault information can be viewed through the object dictionaries 0xF100 and 0xF110 and the module's diagnostic object dictionary 0xAnnn.

When the related fault flag bit of 0xF100h is valid, further details can be obtained through the object dictionary 0xF110h.

The following figure shows the fault relationship.

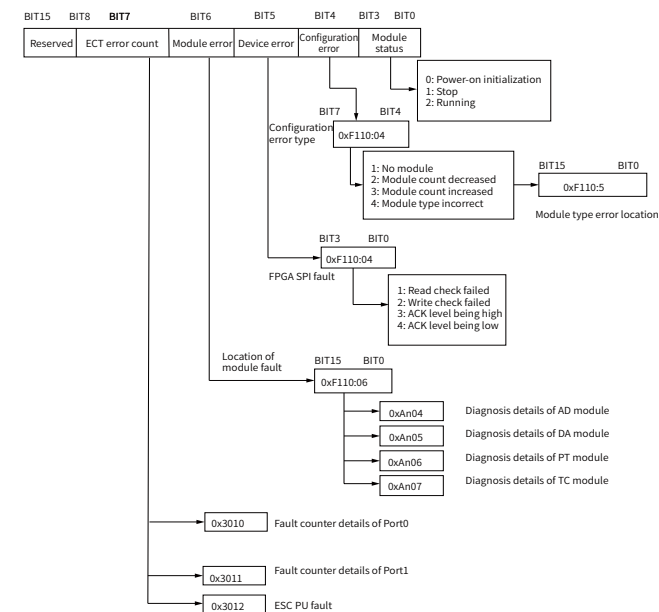


Figure 9 Fault relationship

### Troubleshooting

The following table lists faults of the GL10-RTU-ECTA EtherCAT communication module and their solutions.

| Fault Type          | Cause                                                                                                                          | Solution                                                                                                                                                                                                                                                                                                                                                                                                                   |
|---------------------|--------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| ETC error counter   | ESC detects a communication error due to signal interference or network cable disconnection or other external causes.          | <ul style="list-style-type: none"> <li>◆ Check whether the system power supply is normal.</li> <li>◆ Check whether the network cable is connected properly.</li> <li>◆ Check whether the network cable is inserted firmly.</li> </ul>                                                                                                                                                                                      |
| Module error        | The expansion module is faulty.                                                                                                | <ul style="list-style-type: none"> <li>◆ Check whether the 24 V external power supply is stable and reliable.</li> <li>◆ Check whether the wiring is proper.</li> <li>◆ View the 0xAnnn diagnostic object dictionary of the module to locate the cause.</li> </ul>                                                                                                                                                         |
| Device error        | A device error is mainly caused by abnormal SPI communication between the connector and the expansion module.                  | <ul style="list-style-type: none"> <li>◆ Check whether the expansion module is connected properly and whether the snap-fit joint is fastened.</li> <li>◆ Check whether the module type is matching.</li> <li>◆ Check whether the power supply system is normal.</li> <li>◆ Contact Invoice for technical support.</li> </ul>                                                                                               |
| Configuration error | The connection configuration of the expansion module in the host configuration is different from that of the connected module. | <ul style="list-style-type: none"> <li>◆ Delete the configuration and add the module through auto scanning.</li> <li>◆ Make the expansion module configuration in the host consistent with that of the connected module.</li> <li>◆ After connecting an expansion module to the connector, power off and then on the connector.</li> <li>◆ View the 0XF110 object dictionary of the module to locate the cause.</li> </ul> |